I. C. 6861

NOVEMBER 1935

DEPARTMENT OF THE INTERIOR

UNITED STATES BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

ACCIDENT EXPERIENCE AND COST IN CALIFORNIA METAL MINES

BY

S. H. ASH

AFTER THIS REPORT HAS SERVED YOUR PURPOSE AND IF YOU HAVE NO FURTHER NEED FOR IT, PLEASE RETURN IT TO THE BUREAU OF MINES, USING THE OFFICIAL MAILING LABEL ON THE INSIDE OF THE BACK COVER.

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

I.C. 6861,
November, 1935.

INFORMATION CIRCULAR

DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

ACCIDENT EXPERIENCE AND COST IN CALIFORNIA METAL MINES[1]

By S. H. Ash[2]

CONTENTS

	Page
Introduction	1
Acknowledgment	2
Status of California mining industry	2
Accident experience	3
Fatalities 1 to 31, inclusive	9
Summary of fatalities in California metal mines for 1934	19
Causes of accidents	20
Cost of accidents	22
Compensation costs	25
Medical costs	23
Cost of accidents by causes	28
Conclusions	31

INTRODUCTION

For several years considerable activity[3] has been devoted to economic and social factors affecting California metal-mining operations as they relate to accidents and their cost. The reason for this intense interest is that accidents cost this industry annually over $400,000 in industrial insurance premiums for mines insured by insurance carriers only; during 1924-32, inclusive, they amounted to $3,616,945. There are several reasons for this high cost, the most important of which are the consistently high frequency and severity rates of injuries occurring in the industry. Coordination of effort, appreciation of a mutual problem, and widespread education are essential if accidents and their cost are to be reduced.

1 The Bureau of Mines will welcome reprinting of this Information Circular provided the following footnote acknowledgment is used: "Reprinted from U.S. Bureau of Mines Information Circular 6861."

2 District engineer, U.S. Bureau of Mines Safety Station, Berkeley, Calif.

3 Ash, S. H., Explosives Accidents in California Metal Mines: Inf. Circ. 6725, Bureau of Mines, 1933, pp. 1-2.
Glaeser, Oscar A., Accident Prevention in Metal Mines, with Special Reference to Gold Mining: Min. Cong. Jour., December 1934, pp. 18-21. Presented at Meeting of West. Div., Am. Min. Cong., San Francisco, Calif., Sept. 26, 1934.
California Journal of Development, State Chamber of Commerce, September 1934.

Generated on 2024-09-18 02:00 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This report points out certain factors in accident experience and mining practice that affect accident occurrence and cost to the metal-mining industry of California.

ACKNOWLEDGMENTS

The writer acknowledges the helpful cooperation and information furnished by C. H. Fry, superintendent of safety, F. L. Lowell, supervising mining engineer, and C. R. MacDonald, statistician, of the Industrial Accident Commission; J. J. Gallagher, secretary of the State Fund; W. A. Chowen, manager, California Inspection Rating Bureau; and Thomas Soule, engineer, Industrial Indemnity Exchange.

STATUS OF THE INDUSTRY

Gold mines predominate in California; many of them are small, relatively short-lived, and scattered over the State, usually in isolated sections. A mine employing 10 men is now considered a large mine in California, the leading gold-producing State in the United States. In 1933[4] (table 2) California ranked first in the number of men employed (7,892) and man-hours of labor performed (13,226,793) among the metal-mining States of the United States, followed by Michigan and Minnesota. California leads in the number of operating mines, with 973 for 1933. Accident-prevention difficulties compared with those of some States are apparent when the number of mines is considered - Michigan and Minnesota combined reported 134 mines for the same year. Except for 1930 the number in California reporting to the Industrial Accident Commission has steadily increased from 318 in 1924 to 973 in 1933 (more than 200 percent), and the average number employed per mine has decreased from 19.6 in 1924 to 8.1 in 1933. These facts explain in part the increasing cost of insurance, inspection, and supervision and indicate the necessity for greater emphasis on safety education and increased supervision.

Accident costs have increased with the increase in number of operations and the decrease in number of employees in the average mine. The classification rate per $100 of pay roll for mining was $5.81 in 1924 and $11.85 in 1933. Revision of classification reduced this rate to $11 in 1934 and 1935. This does not mean that the total amount paid by the industry will be reduced, for unless

---

4 Adams, W. W., Metal-Mine Accidents in the United States During the Calendar Year 1932: Bull. 377, Bureau of Mines, 1934, p. 5.
Accident-Prevention Record of the Metal-Mining Industry in the United States in 1933, Including Nonmetallic Mineral Mining Other than Coal: Health and Safety Statistics 185, Demographical Division, Bureau of Mines, Dec. 6, 1934.

5 Ash, S. H., Explosives Accidents in California Metal Mines: Inf. Circ. 6725, Bureau of Mines, 1933, pp. 1-2.

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

accident costs were reduced in 1934 the excess cost was merely distributed in the new classifications and must be paid in the end. The encouraging fact is that the rate for 1935 remains unchanged, which shows that accident-prevention work apparently is producing results. A review of fatalities for 1934, however, shows that unless efforts are intensified the desired relief is not in sight insofar as human suffering is concerned.

ACCIDENT EXPERIENCE

For many years the United States Bureau of Mines has been compiling and publishing annually statistics on accidents in the mineral industries. Prevention of accidents requires a knowledge of the exposure to which the workmen are subjected; number, frequency, and severity of injuries and time lost therefrom; nature of injuries; and causes of accidents. The nature of injuries often indicates that certain safety-equipment and first-aid practices if applied properly will prevent many types of costly injuries. The same is true to a certain extent of the causes of injuries usually given, which are merely the names of certain physical agencies by which the injuries are inflicted. Complete accident reports should therefore be available so the interested, safety-conscious management will see that the real causes of accidents involve mining practice, equipment, and human factors.

The tables given compare the accident experience in California metal mines over a period of years. The accident rates are based on man-hours of exposure, and accident-frequency (number of accidents per million man-hours of exposure) and accident-severity (time lost per thousand man-hours) rates are used. These tables include all lost-time injuries, although for compensation-cost purposes California has an absolute 7-day waiting period which is included in all lost-time data.

Table 1 shows the number of injuries and time lost for all lost-time injuries by class of injury at all California metal mines for 1929-33, inclusive.

Table 2 shows the number of mines, man-hours of exposure, and accident-frequency, fatality, and injury rates in California metal mines for 1924-33, inclusive.

In tables giving data for all mines Bureau of Mines classifications[6] are used; these include self-insurers and other groups not included in risks in classification 1164, Mining, N.O.C., held by the California insurance carriers.

---

6 Adams, W. W., Metal-Mine Accidents in the United States During the Calendar Year 1928: Bull. 320, Bureau of Mines, pp. 4, 63.

Generated on 2024-09-18 01:59 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 1.- Number of injuries and days lost for all lost-time injuries by class of injury at all California metal mines, 1929-33, inclusive[1]

Class of injury	1929		1930		1931		1932	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
Killed	31	186,000	29	174,000	15	90,000	25	150,000
Permanent total disability	---	---	---	---	---	---	---	---
Permanent partial disability	22	17,600	25	20,000	23	18,400	18	14,400
Temporary disability	1,426	19,476	1,386	18,018	1,137	14,781	911	11,843
All nonfatal	1,448	37,076	1,411	38,018	1,160	33,181	929	26,243
Grand total	1,479	223,076	1,440	212,018	1,175	123,181	954	176,243

Class of injury	1933		1924-28		1929-33	
	No. of injuries	Days lost	No. of injuries	Days lost	No. of injuries	Days lost
Killed	9	54,000	129	774,000	109	654,000
Permanent total disability	1	6,000	2	12,000	1	6,000
Permanent partial disability	21	16,800	174	139,200	109	87,200
Temporary disability	1,558	20,254	8,156	111,752	6,418	84,372
All nonfatal	1,580	43,054	8,332	262,952	6,528	177,572
Grand total	1,589	97,054	8,461	1,036,952	6,637	831,572

1 Compiled from Bureau of Mines reports on metal-mine accidents in the United States.

Generated on 2024-09-18 01:54 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 2.- Accident and frequency rates and man-hours of exposure in California metal mines, 1924-33, inclusive 1/

Year	Number of mines	Men employed	Man-hours worked	Killed	Injured	Rate per million man-hours	
						Killed	Injured
1924	318	6,238	15,440,784	32	1,840	2.07	119.17
1925	344	7,078	17,129,472	30	1,870	1.75	109.17
1926	415	6,849	16,522,760	38	1,793	2.30	108.52
1927	453	6,584	14,465,112	19	1,548	1.31	107.02
1928	496	6,433	13,867,784	10	1,281	.72	92.37
1929	538	7,455	15,297,376	31	1,448	2.03	94.65
1930	476	5,941	11,908,896	29	1,411	2.43	118.48
1931	640	5,553	10,755,493	15	1,160	1.39	107.85
1932	817	5,646	10,051,955	25	929	2.49	92.42
1933	973	7,892	13,226,793	9	1,580	.68	119.45
1924-28	2/405	2/6,636	77,425,912	129	8,332	1.67	107.61
1929-33	2/689	2/6,498	61,240,513	109	6,528	1.78	106.60

1 Compiled from Bureau of Mines reports on metal-mine accidents in the United States.
2 Average.

According to data in table 2 the accident rates for the two 5-year periods 1924-28 and 1929-33 virtually have stood still, the fatality severity rate showing an increase during the last 5-year period due to the mine-fire catastrophe in 1930 and the "high explosives" and "falling-in-shaft" accidents during this period.

A careful review[7] of all mine-accident statistics for California shows that the fatal-accident rates are a more reliable indication of the trend of safety performance over a long period than relatively recent rates that include nonfatal temporary and partial-disability accidents that enter directly into compensation insurance awards. Table 2 shows emphatically the necessity for changes in mining practice relating to safety, as the accident occurrence as well as accident rates are unduly high and show little if any tendency to improvement.

Table 3 gives the frequency and severity rates for all accidents at all mines during 1924-33. The Bureau of Mines schedule of time lost for injuries[8] has been used in accordance with the scale adopted by the Association of Industrial Accidents Boards and Commissions, which is -

7 Ash, S. H., Mine Safety Practices: California Jour. of Development, State Chamber of Com., September 1934, pp. 16, 46.
Ash, S. H., Explosives Accidents in California Metal Mines: Inf. Circ. 6725, Bureau of Mines, 1933, pp. 1-2.
8 Adams, W. W., Metal-Mine Accidents in the United States, 1930: Bull. 362, Bureau of Mines, 1932, p. 62.

Generated on 2024-09-18 01:54 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

	Weighted at, days
Death	6,000
Permanent total disability	6,000
Permanent partial disability	800
Temporary disabilities (1 day or more)	13

Table 4 shows the frequency and severity rates for all lost-time injuries by class of injury at all California mines for 1929-33, inclusive, and the average for the 5 years 1924-28.

A review of frequency data alone of all lost-time accidents often leads to misconception of safety work and accident-cost rates. Unquestionably the accident-frequency rate which is so readily available furnishes the "prodding" tool for the safety-conscious mine manager, but the severity of injuries is the factor that indicates the hazard of the industry, the extent of human suffering, and the cost of accidents.

TABLE 3.- Man-hours worked and accident frequency and severity rates at all metal mines in California, 1924-33 1

Year	Man-hours worked	Accident-frequency rate	Accident-severity rate
1924	15,440,784	121.24	16.844
1925	17,129,472	110.92	13.733
1926	16,522,760	110.82	17.182
1927	14,465,112	108.33	10.935
1928	13,867,784	93.09	7.130
1929	15,297,376	96.68	14.582
1930	11,908,896	120.91	17.814
1931	10,755,493	109.24	11.454
1932	10,051,955	94.91	17.535
1933	13,226,793	120.13	7.326
1924-28	77,425,912	109.278	13.393
1929-33	61,240,513	108.386	13.569

1 All lost-time accidents are taken from Bureau of Mines bulletins on metal-mine accidents in the United States.

Analysis[9] of accident rates indicates that the frequency of fatal accidents over a long period is of more value in projecting the severity of all accidents than the frequency figure for all nonfatal accidents. The significance of this statement is indicated in table 4 by the frequency (1.78) of fatalities and the severity (13.57) for all injuries for the period 1929-33, which are greater than the frequency (1.67) and the severity (13.39), respectively, for the 5-years 1924-28; as regards human suffering and economic loss the later period was worse. Economically this is reflected in increased compensation insurance rates, as indicated by the cost rates at the close of each period.

9 Ash, S. H., Accident Prevention and Statistics in Tunneling Operations: Presented at the meeting of the General Safety Committee of the Metropolitan Water District of Southern California, Oct. 8, 1934.

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 4.- Frequency and severity rates for all lost-time injuries by class of injury at all California mines, 1929-33, inclusive

Class of injury	1929		1930		1931		1932	
	Frequency	Severity	Frequency	Severity	Frequency	Severity	Frequency	Severity
Killed.....	2.03	12.16	2.43	14.62	1.39	8.37	2.49	14.92
Permanent total disability.....	------	--------	------	--------	------	--------	------	--------
Permanent partial disability.....	1.44	1.15	2.10	1.68	2.14	1.71	1.79	1.43
Temporary disability[1].....	93.21	1.27	116.38	1.51	105.70	1.37	90.63	1.18
All nonfatal.....	94.65	2.42	118.48	3.19	107.85	3.08	92.42	2.61
Grand total.	96.68	14.58	120.91	17.81	109.24	11.45	94.91	17.53

Class of injury	1933		1924-28		1929-33	
	Frequency	Severity	Frequency	Severity	Frequency	Severity
Killed.....	0.68	4.07	1.67	10.00	1.78	10.67
Permanent total disability.....	.08	.45	.03	.15	.01	.10
Permanent partial disability.....	1.59	1.27	2.25	1.80	1.78	1.42
Temporary disability 1/.....	117.78	1.53	105.33	1.44	104.81	1.38
All nonfatal.....	119.45	3.25	107.61	3.39	106.60	2.90
Grand total.....	120.13	7.32	109.28	13.39	108.38	13.57

1 Disability for more than remainder of day of accident.

On the other hand, the total frequency figure dropped from 109.28 to 108.38. The remedy for reducing severity lies in reducing the frequency of serious accidents resulting from falls, blasting, falling down shafts, suffocation, and fires, as well as other infrequent causes.

Comparison of accident rates with accident costs shows that a high total severity rate for any one year is not always reflected in higher costs, as fatal accidents, although of maximum severity, cost less than some types of serious nonfatal injuries because of the comparatively low financial remuneration for a fatality which is based on dependency and also is limited (table 9, p. 24). The relative value of the compensation item of accident costs projected from the severity rate in California is in the following order: (1) Compensable nonfatal, (2) all lost-time nonfatal, (3) all injuries, and (4) fatalities.

Table 5 gives fatalities by causes at all California metal mines for 1928-32.

Generated on 2024-09-18 02:01 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 5.- Fatalities by causes at all California metal mines for the calendar years 1928-32, inclusive

Cause	1928	1929	1930	1931	1932	1928-32 Total	1928-32 Percentage of total
Underground:							
Falls of rock or ore from roof or wall	3	13	6	7	3	32	29.09
Timber or hand tools	----	----	2	----	----	2	1.82
Explosives	----	6	5	2	9	22	20.00
Haulage	----	----	3	1	----	4	3.64
Falling down chute, winze, raise, or stope	1	1	1	3	1	7	6.37
Run of ore from chute or pocket	----	1	----	----	----	1	.91
Electricity	----	----	----	----	1	1	.91
Machinery other than locomotives or drills	1	----	1	----	----	2	1.82
Mine fires	----	----	5	----	----	5	4.54
Suffocation from natural gases	1	2	----	----	3	6	5.45
Inrush of water	----	----	1	----	----	1	.91
Subtotal	6	23	24	13	17	83	75.46
Shaft:							
Falling down shaft	----	4	1	----	1	6	5.45
Objects falling down shaft	----	----	1	----	1	2	1.82
Breaking of cables	----	----	----	2	----	2	1.82
Skips, cages, or buckets	1	3	2	----	2	8	7.27
Subtotal	1	7	4	2	4	18	16.36
Surface:							
Electricity	----	----	----	----	2	2	1.82
Machinery	1	----	----	----	1	2	1.82
Handling materials	----	----	1	----	1	2	1.82
Other causes	2	1	----	----	----	3	2.72
Subtotal	3	1	1	----	4	9	8.18
Grand total	10	31	29	15	25	110	100.00

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Although statistical data for previous years are necessary for projecting accident experience, yet the same accidents are happening now in much the same way and from the same causes because certain mining practices conducive to accidents remain unchanged for the industry as a whole. As accident-prevention work progresses in certain mines (and it has considerably in California) with beneficial results, in other less safety-conscious mines conditions remain the same, and the sum total of compensable accidents is the same or only slightly unchanged. A review of the fatalities at all metal mines in California during 1934, coming to the attention of the United States Bureau of Mines, is therefore presented. These data are tentative and subject to revision.

Fatality 1

A gold-dredge shore boss, whose age was not given, received injuries about the head and died 2½ months later. He was struck by a "come along." Foremen should be more familiar with cable hazards[10] than other employees, but far too frequently they are inclined to "take chances" for which they would condemn their employees.

Fatality 2

A timberman 33 years old received an eye injury which later became infected and caused his death about 2½ months later. This accident was caused by a small fragment of rock flying from a rock which a fellow workman was breaking with a hammer. Such injuries can be prevented by wearing proper goggles. The danger from infection of injuries about the head is emphasized by this fatal accident.

Fatality 3

A 22-year-old shop laborer of a gold-dredge crew was electrocuted when he contacted a high-tension wire while assisting the surveyor. Familiarity with the hazards of the surroundings and care in avoiding them can prevent this type of accident, which is not uncommon when a workman follows other than his regular occupation.

Fatality 4

A miner 40 years old was killed at a gold mine when struck on the head by a piece of rock falling down the manway of a raise. The man was climbing the ladder in the manway of the raise at the beginning of the shift to investigate the amount of rock to be drawn from the chute while his partner had gone after a car. A rock weighing about 8 pounds, probably lying in the manway, became dislodged in some manner and struck him on the head.

Head protection with any of the hats now available might have saved this life. This is required at most of the large mines in California and should be required of all workmen at all mines, large or small.

---

10 Ash, S. H., Safety Practices in California Gold Dredging: Bull. 352, Bureau of Mines, 1932, 31 pp.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fatality 5

A miner 48 years old was asphyxiated from powder gas in a gold mine. Five men, working this mine under a "partnership", were driving a drift which had progressed about 250 feet from a shaft at the 250-foot level; the shaft dips about 70°.

A round of 14 holes using 70 sticks of 1½- by 8-inch gelatin dynamite, with fuse and caps, had been blasted in the drift at 5 p.m., when the men went off the shift; about 7:45 p.m. the deceased and another man went down the shaft to inspect the result. About 10 p.m. a brother of one of the men went to see why they had not returned; a short distance in he found one of the men apparently dead, and farther in he found his brother unconscious. He dragged both men to the landing and after obtaining assistance took the injured men to the surface and sent for a doctor. When the doctor arrived one man had revived, but efforts to revive the other failed.

This is another example of an accident resulting from lack of ventilation and safe practice at a "partnership" mine. Had the rescuers been familiar with first-aid resuscitation methods one man could have been revived quickly (he revived in fresh air), and perhaps the other man could have been resuscitated. However, the man who revived without treatment was the only one who knew how to administer first aid. This accident illustrates the value of 100-percent first-aid training in which all persons at a plant take the full Bureau of Mines course of instruction in first aid.

These men are said to have thought there was no danger from the fumes of the explosive they were using, basing their belief upon a notation enclosed in the boxes used for the explosive.

The compressed air was insufficient to clear the place in time. This accident shows plainly the lack of intelligent supervision and need for better ventilation[11] in some of the metal mines of this country.

Fatality 6

A mule driver 39 years old was killed at a nonmetallic mineral mine when crushed between a car and the ribs of the drift. He lost control of the mule hauling the car and was squeezed between the car and the side wall. The deceased left a widow and seven children.

This type of accident is common when men ride on the front car bumper or on the tail chain instead of riding the back bumper or if possible inside an empty car and suggests at least more clearance for such haulage.

---

11 Harrington, D., and Denny, E. H., Gases that Occur in Metal Mining: Bull. 347, Bureau of Mines, 1931, 21 pp.

Generated on 2024-09-18 01:54 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fatalities 7 and 8

A miner 38 and a mucker 22 years old were killed by a slide of rock at a gold mine. At the time of the accident the two men were "cleaning-up" and pulling out old timbers from a shrinkage stope and were buried by a slide. Evidently the timbering was inadequate, and when timbers were removed the rock was released. Shrinkage stopes present many hazards due to lack of timbering, and at the time of cleaning it often is impossible to test the walls. Squaresets and even cribbing often are advisable in questionable ground. Careful inspection and precautionary measures to control the ground will prevent such accidents.

Fatality 9

A timberman 33 years old was killed at a gold mine by a fall of hanging-wall rock. He was removing timbers to build a chute; when a stull was removed a slab of rock slid from the hanging wall, breaking another timber and crushing the timberman. Evidently removal of the stull weakened the ground, and the deceased erred in not properly securing the hanging wall or used poor judgment in testing the overhanging material.

Fatality 10

A miner 65 years old was killed at a small gold mine by flying rock from a blast. He and his partner were the only workmen at this mine. They had drilled and loaded a round of 7 holes in a crosscut they were driving and were lighting the fuses with their carbide lights. The deceased had just renewed the carbide charge in his lamp, and the gas pressure was so strong the lamp would not stay lighted. He reached over to take a light from his partner's lamp but in doing so extinguished the partner's light also, leaving them in darkness. They started to walk in the dark, following the rails of the track to a point about 80 feet away where the crosscut intersected a drift. A mine car was on the track between the face and the drift around which they had to pass. The deceased's partner reached the drift, where he waited, and presently the shots went off. He succeeded in lighting his lamp and not seeing his partner started for the face and found him lying stretched out toward, and about 40 feet from, the face. He was dead, with a rock about the size of an egg embedded in his skull. It is thought that he lost his sense of direction in going around the car and was walking back toward the face in the dark when the blast went off. Neither of the men wore head protection which, while not intended for cases of this kind, nevertheless has saved lives under similar circumstances.

This accident is typical of an alarming number from blasting that continue to occur in California mines. It could have been prevented if the men had been provided with electric cap lamps, or if another lighted lamp had been in the drift, or if some method of electric blasting had been used.

Generated on 2024-09-18 01:59 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This type of accident, caused in this instance by experienced men, is one of the main reasons for high accident rates and costs in California.

Fatality 11

A miner 50 years old was killed at a gold mine when he walked into a blast in which fuse and caps were used. At the time of the accident some holes were being blasted on a road job leading to the mine. The deceased, an experienced miner, is said to have paid no attention to the blasting signals or personal warning but walked directly into the blast.

This accident also is more or less typical; the deceased ignored the warnings, misunderstood them, or did not hear them. Many accidents of this type can be prevented by electric blasting whereby the moment of firing is in control at essentially all times.

Fatality 12

A miner 36 years old was killed at an underground silica mine by an air blast from a cave. After shooting 2 rounds of holes intended to cave 2 weak pillars and the capping over some old stopes the deceased started to enter one of the stopes almost immediately after the shots had been fired; he was traveling from the surface through a raise connecting with the stope when a cave occurred (capping fell). The force of the resulting air blast hurled him several hundred feet, causing fatal injuries.

This type of accident is not uncommon and reveals an error in judgment, as air blasts while by no means numerous can be expected under such circumstances. Many workmen are killed, directly or indirectly, by entering working places too soon after blasting, particularly when blasting is done at any time during the working shift. Such accidents can be avoided by blasting at the close of the shift, if at all feasible; by keeping the face clear of workmen for some time; by closer supervision; and by the exercise of better judgment by the workman himself. No one unfamiliar with such work should do blasting.

Fatality 13

A mucker 21 years old was killed at a gold mine by a fall of rock in a stope. At the time of the accident ore was being drawn from the stope through the chute. The man was crossing the stope when a slab of rock from the hanging wall struck him. The roof rock, evidently loose, probably was weakened by the removal of some of the loose ore. It may have been working loose, and the deceased did not hear it owing to the noise. Similar accidents can be avoided by careful testing and closer inspection of the roof and by taking down, barring or otherwise, or timbering dangerous rock.

Fatality 14

A miner 48 years old was hit by a fall of rock at a gold mine and died from the injuries 1 week later. This accident occurred at the working face while the deceased was drilling his round. Two holes had been drilled, and

Generated on 2024-09-18 01:59 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

the miner was drilling the third when a slab of rock fell from the back and struck him on the head. Death resulted from concussion of the brain, as an X-ray showed no fracture. It is stated that the deceased was wearing a "hard-boiled" hat at the time and also had barred down. He left a widow and 10 children.

An accident of this type is not uncommon during drilling. Rock that appears safe and resists barring down becomes loose through jarring of the drill; this emphasizes the necessity of testing the roof frequently during drilling operations. Moreover, too much reliance should not be placed on "head protection", which has its limitations although it has prevented and will prevent many serious and minor injuries.

Testing the overhead material in mine workings is one of the most important factors in preventing injuries from falls of overlying material and should be done systematically and often. Experienced miners can thus determine the security of the overlying material and know when to take down dangerous material or to set timber to secure it against falling.

Two methods generally are used to test the back; each involves striking the overlying material with a wooden or metal tool or rod. Striking the back produces sound and vibration. A "drummy" or hollow sound usually indicates that the material is loose, but absence of sound does not always indicate that it is safe. Vibration usually can be felt by the bare fingers or hand in contact with the material being tested. The amount of vibration produced when the material is struck is a better indication of the firmness or looseness of the material; hence, the vibration method should be used where at all feasible. By this method the back or roof material is struck with a rod held in one hand, while the bare fingers of the other are held against the material. The person doing the testing thus has the benefit of both sound and vibration. Vibrations that are easily felt indicate loose material, which should be taken down or supported by timber. Some large pieces of loose roof material may vibrate only slightly if at all and make no drummy sound; this condition is unusually hazardous and shows the necessity of using systematic timbering if adequate protection is to be afforded at all times and under essentially all conditions.

Fatality 15

A millman 65 years old was killed at a gold mine while oiling the machinery in the ore mill. His clothing caught in the drive shaft of the machinery which broke his neck and back and caused other injuries.

The remedy for preventing such accidents is the proper guarding of machinery; if it cannot be guarded it should be fenced off; and if for any reason it is necessary to remove guards or to oil unguarded the machinery should be stopped and not started again until the oiler in person reports this fact to the operator of the driving engine or mechanism. Men working around machinery with moving parts should be so dressed that few if any parts of the clothing are loose enough to be caught in the machinery.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fatality 16

A skip tender 43 years old was killed at a gold mine while riding on a water skip in the course of his duties. The skip jumped the track and caught his leg between the bail and the skip, fracturing his leg at the femur and severing an artery; he bled to death.

This life undoubtedly could have been saved by proper first-aid treatment -- an instance indicating the necessity for 100-percent first-aid training at all mines.

The accident might have been prevented by some arrangement to dispense with riding skips. Water skips usually do not run under the same conditions as ore skips. Frequently they are run into poorly tracked sumps at high speed; water spilling from the skip often washes material onto the track and causes derailments; and maintenance is often neglected.

Fatality 17

A miner 36 years old was killed and a fellow workman injured by a fall of back at a gold mine. The men were timbering a section of the back near the face in a long raise with a treacherous hanging wall when a portion of it broke.

Such accidents can be prevented only by systematic timbering and careful testing of the overlying material. Accidents during timbering operations are avoidable; the fact that the back requires support emphasizes the necessity for more care in working under dangerous overhead material.

Fatality 18

A filter tender 24 years old was fatally burned by hot solution in a nonmetallic mineral mine. He was closing the valves of an Oliver filter in the surface evaporation building when a hose connection burst and the hot liquid issuing from the break burned him.

Accidents due to failure of pipe lines, hose or their accessories, often show evidence of faulty equipment on careful inspection. They can be prevented by care in operating connections or valves so as not to cause strains, which may result in ruptures. Relief valves should be properly placed to take care of contingencies, and instructions should be issued and enforced regarding proper operation.

Fatality 19

A mine foreman 61 years old was killed at a gold mine while riding to the surface on an ore skip; he was caught between the skip and the chute spout at a station, and his head and chest were crushed.

Generated on 2024-09-18 02:01 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This common shaft accident can be prevented by riding properly in skips. Mine foremen should be more familiar with dangers in a shaft than other workmen. It is unfortunate that officials far too frequently ride haulage equipment under conditions so hazardous as to be prohibited for other workmen; in addition to the danger to officials, this foolhardiness sets a bad example and encourages other workmen to disobey regulations.

Fatalities 20 and 21

Two miners 43 and 45 years old, respectively, were killed by a fall of roof at a gold mine. These men were working in an open cut-and-fill stope; a change of ground occurred, and there was no timber in the stope. A large portion of the overlying material caved without warning and crushed the two men.

This accident shows the danger of placing too much dependence upon so-called "good back." Safe conditions are taken for granted, with disastrous results sooner or later. Proper testing of the roof or back and adequate timely timbering would have prevented this accident.

Fatality 22

A miner 37 years old died from injuries received from a falling timber in the course of his duties at a gold mine. His leg was fractured, and he died from pulmonary embolism.

Accidents from this cause often result if the timber is handled improperly, knocked out by some other agency, or released by some other workman, or falls off trips while being hauled. Determining the remedy is relatively simple, but seeing that it is applied at all times is a wholly different matter.

Fatality 23

A miner 32 years old died the day after injuries received from a fall of rock while working underground at a gold mine.

No other details of this accident were available.

Fatality 24

A partnership miner 44 years old was killed by a slide of rock at a surface placer mine. He had completed his work and sat down to rest in a cut in the gravel bank in which he had been working. Rain had loosened the ground, and a rock broke loose and crushed the deceased. A newspaper item referred to this fatality as a "freakish" accident. There is nothing "freakish" about a bank sliding in; it can be anticipated in any freshly dug, unsupported trench. Such accidents often occur in small prospects in the absence of responsible supervision and adequate safety precautions. It is essentially as important to rest in a safe place as to work in one.

Generated on 2024-09-18 01:59 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fatality 25

A miner 40 years old was killed at a gold mine by a fall of rock. In this instance the deceased had sounded the roof and picked it down preparatory to drilling. He drilled the round and was taking the drill bar back in the stope when a slab fell and crushed his body.

This accident is similar to fatality 14; the jarring of the drill evidently loosened the back. Failing to test the roof or back frequently, the man was unaware of its condition.

Fatality 26

A mine foreman 48 years old was asphyxiated from powder gas at a gold mine. Three rounds had been blasted in a raise, and the deceased and another man went into the raise to inspect the results of the blasts. The foreman was totally overcome with gas, and the other man was incapable of giving assistance but managed to get out. Persons with a knowledge of first aid were not available to give assistance, again indicating that all persons employed in mining should be required to have an adequate knowledge of first-aid work.

This accident, similar to fatality 5, emphasizes the need of ventilation, more intelligent supervision, and knowledge of first aid at small metal mines. The excessive use of explosives, aside from causing fatalities, contributes much to the ill health of many miners, particularly when they go into the gassy dust-laden air too soon after blasting.

Fatality 27

A mucker 28 years old was killed by a fall of roof in a gold mine. In this instance the man was mucking out an old tunnel preparatory to retimbering; the walls caved, crushing his chest and skull.

This accident indicates lack of proper supervision, inspection, and support of the ground to be retimbered; in all probability removing the muck disturbed the ground and old timbers and permitted the ground to cave.

Fatality 28

A miner at a "partnership" gold mine was killed by a fall of rock. Two men were opening an old mine; one of them decided to go to an adjacent old mine and get some timber. Removing the timber caused a cave, with fatal results.

Such conditions are likely to prevail at small mines and prospects being opened for sampling or possible operation; they contribute to offset increased safety at operating mines and also affect the accident record of the whole industry.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Fatalities 29 and 30

A miner was asphyxiated instantly, another miner died later, and one was made seriously ill at a gold mine by fumes from a dynamite explosion. The explosion occurred from an unknown cause when the deceased miner entered an underground magazine against orders. As a result of the blast another man was asphyxiated in leaving his nearby working place and, although rescued, died later from the effect of the fumes. His rescued partner recovered.

This accident shows how one man's mistake or carelessness may endanger the lives of others. Another workman who was responsible for saving one of the men risked his life in a desperate attempt to save both.

Compliance with well-considered rules and regulations will prevent such accidents.

Fatality 31

A miner 21 years old was killed when he fell down a shaft at a gold mine. The man was descending the ladder in a shaft which dipped 60°; his back was turned toward the ladder when he slipped and fell about 175 feet, fracturing his skull.

Obviously this man was descending the ladder in the wrong manner. Such accidents can be prevented by traveling ladders properly, by having landings at safe intervals where men use ladders, and by providing handrails. Rubber packs or boots, which are not safe for use on ladders, have contributed to the death or injury of many from slipping.

Table 6 shows the number and percentage of fatal injuries by causes for 1934.

Table 7 shows the number of fatalities during 1934 by occupation.

Generated on 2024-09-18 01:58 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 01:58 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 6.- Fatal injuries during 1934 by causes

Cause	Fatalities	
	Number	Percentage
Falls of ground:		
Placer gravel bank caved	1	3.23
Fall of rock	1	3.23
Fall of rock while timbering	1	3.23
Fall of rock in stope while pulling ore	1	3.23
Air blast from cave following blasting	1	3.23
Fall of roof on removing muck or timber	3	9.68
Fall of roof in stope or raise	2	6.44
Slides of rock in shrinkage stope	2	6.44
Rock coming down manway	1	3.23
Fall of rock while drilling	2	6.44
Subtotal	15	48.38
Explosives:		
Overcome by powder smoke following blasting	2	6.44
Explosion of dynamite in underground magazine	2	6.44
Struck by flying rock from blast	2	6.44
Subtotal	6	19.32
Haulage:		
Caught between skip and shaft timbers	1	3.23
Caught between bail and skip	1	3.23
Crushed between car and rib	1	3.23
Subtotal	3	9.68
Other causes:		
Slipped and fell down shaft	1	3.23
Struck by "come-along" of cable (surface)	1	3.23
Struck in eye by flying piece of rock from hammer	1	3.23
Electrocuted by high-tension wire (surface)	1	3.23
Struck by falling timber	1	3.23
Clothing caught in mill machinery drive shaft (surface)	1	3.23
Burned by hot liquid at surface cleaning plant	1	3.23
Subtotal	7	22.58
Underground	24	77.42
Surface	7	22.58
Grand total	31	100.00

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 7.- Fatal injuries during 1934 by occupation

Occupation	Fatalities	
	Number	Percentage
Foreman[1] or shift bosses	3	9.68
Miners (under safety act)	13	41.93
Miners (partnership mines)	4	12.90
Muckers	4	12.90
Timbermen	2	6.44
Driver	1	3.23
Skip tender (underground)	1	3.23
Shop helper	1	3.23
Millman	1	3.23
Filter-plant operator (surface)	1	3.23
Total	[2]31	100.00

1 1 killed on surface.
2 7 killed on surface.

SUMMARY OF FATALITIES IN CALIFORNIA METAL MINES, 1934

The 1934 fatality record of 31 deaths, compared with 9 for 1933, was significant in that the exposure in 1934 probably did not exceed if it equaled that of 1933, owing to the sustained suspension of operations at the large mines of the Mother Lode district.

Of the 31 men killed 14 were single men, 13 were married, and 4 were widowers with dependents; 35 orphans and 2 parents of single men were involved in the dependency. The peak months for fatalities were April and July with 5 each. June had no fatalities; March, September, and November had 1 each; January and February 2 each; August, October, and December 3 each; and May 4.

One mine had 3 accidents with 3 fatalities, and 2 mines had 1 accident each with 2 fatalities each. These fatalities occurred at large mines.

The increase of fatalities from rock falls from an average of 33 percent in 1924 to 48.38 percent in 1934 emphasizes the need of closer supervision and inspection and enforcement of timbering safety rules.

Explosives rank second as a cause of accidents with 20 percent of the fatalities — an unenviable position probably not duplicated in any other mining State.

The 3 (9.68 percent) fatalities among foremen show the high accident frequency and severity of this occupation and reflect unsafe conditions and practices, chance-taking, and especially the need of more thorough safety education for these officials. The 17 miners killed (53.83 percent of the fatalities) emphasize the need of accident-prevention methods at the working face.

Generated on 2024-09-18 01:58 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CAUSES OF ACCIDENTS

The fatal accidents that occurred during 1934 are fairly typical of mine accidents in California. A comparison of statistics in tables 5, 6, and 7 reveals the constancy of certain agencies in causing the injuries.

The causes and means of prevention of accidents at California mines are discussed in the annual reports[12] of the United States Bureau of Mines and in several individual reports.[12] Probably no single item offers a more fertile field for reducing California mine accidents than the use of explosives, which accounts for 20 percent of the fatalities and coincidentally the same percentage of the accident cost. This item shows the significance of the human suffering and economic loss resulting from unsafe explosives practices.

Mine fires are more important[13] than is generally realized and are increasing as potential factors for disasters involving groups of men, owing to the increasing number of small-mine operations. During the 16-year period 1915-30, inclusive, 55 (10.1 percent) of the fatalities in California mines were caused by mine fires and 2 methane-gas explosions; from 1924-27, 2.5 percent of the fatalities were due to mine fires; from 1928-32, 4.5 percent; and during 1934 there were several fires, but fortunately no lives were lost.

A remedy for improving accident severity, which has shown almost a level trend for the past decade, is indicated by the causes of fatal and nonfatal accidents.

Fatalities in California for 1934 rank in order of importance and percentage of total as follows: (1) Falls of back or face and slides, 33.46 percent; (2) explosives, 17.69 percent; (3) falling in shafts, 14.63 percent; (4) falls of persons, 7.69 percent; (5) haulage, 4.61 percent; (6) falling and flying objects, 4.23 percent; (7) machinery, 3.85 percent; (8) mine fires and explosions other than explosives, 3.07 percent; (9) suffocations from

---

12 Adams, W. W., Metal-Mine Accidents in the United States During the Calendar Year 1932: Bull. 377, Bureau of Mines, p. 5.
Accident-Prevention Record of the Metal-Mining Industry in the United States in 1933, Including Nonmetallic Mineral Mining Other Than Coal: Health and Safety Statistics 185, Demographical Division, Bureau of Mines, Dec. 6, 1934.
Cannon, F. C., Accidents in Metal Mines Due to Falls of Men and Materials: Rept. of Investigations 2944, Bureau of Mines, June 1929, 9 pp.
Ash, S. H., Explosives Accidents in California Metal Mines: Inf. Circ. 6725, Bureau of Mines, 1933, 18 pp.
Pickard, B. C., Lessons From the Fire in the Argonaut Mine: Tech. Paper 363, Bureau of Mines, 1926, 39 pp.
Ash, S. H., Safety Practices in California Gold Dredging: Bull. 352, Bureau of Mines, 1932, 31 pp.

13 Glaeser, Oscar A., Accident-Prevention in Metal Mines: Min. Cong. Jour., December 1934, pp. 18-21.

Generated on 2024-09-18 02:03 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

mine gases and deficiency of oxygen, 2.31 percent; (10) others, including electrocutions and floods, 8.46 percent.

As regards relative hazardousness of location underground and man-hours of exposure in breaking ground, in which operation most fatal and nonfatal accidents occur, drifting is the least hazardous and sinking shafts, stoping, and driving raises, in order named, the most hazardous.

TABLE 8.- Rank and percentage of nonfatal accidents in California mines according to cause, 1924-34

Rank	Cause	Percentage
1	Falls or slides of rock or ore from back or wall	20.02
2	Timber or hand tools	12.76
3	Haulage	10.04
4	Falls, runs, or slides of rock or ore while loading at face, from chute, pocket or bins, and while shoveling or handling material at grizzlies	9.43
5	Falling down chute, winze, raise, or stope	8.17
6	Drilling	7.20
7	Machinery	4.83
8	Stepping on nails	3.64
9	Falls of persons	3.34
10	Skips, cages, or buckets	1.79
11	Explosives	1.20
12	Objects falling down shaft	.49
13	Falling down shaft	.40
14	Electricity	.39
15	Suffocation from mine gases	.18
16	Mine fires	.10
17	Other causes	16.02

According to table 8 certain causes of accidents form a high percentage numerically and in severity rates for fatal accidents, with a low percentage in frequency and number in nonfatal accidents; to this class belong accidents from skips, cages, or buckets, with explosives and others ranking 12 to 16. On the other hand, such accidents are decidedly severe and form the major items in permanent and partial disability claims when they do not result in fatalities. These items are of prime concern to the insurance carrier.

The importance from a compensation standpoint of some classes of injuries is not revealed by the cause; one nonfatal accident in a California mine resulting from the use of hand tools cost $15,228 for compensation and medical aid.

The parts of the body that are most difficult to protect in mine accidents are hands, insteps, and legs; the importance of such protection is emphasized by the fact that injuries to the hands ranked third in importance and constituted 10.23 percent of the injuries in 1,778 nonfatal accidents in California mines, while fingers ranked first with 18.24 percent and legs second with 10.62 percent.

Generated on 2024-09-18 02:04 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The importance of protective clothing is shown by the classification (in the study of the 1,778 nonfatal accidents mentioned above) of injuries according to part of body injured, which ranked in importance and percentage as follows: (4) Feet, 10.18 percent; (6) eye, 9.40 percent; and (8) head, 5.62 percent.

In a study of 1,638 nonfatal and 42 fatal injuries at California metal mines the injuries according to nature ranked as follows: (1) Cuts, lacerations, and punctures, 30.16 percent; (2) bruises, contusions, and abrasions, 23.46 percent; (3) miscellaneous, 19.38 percent; (4) sprains and strains, 12.81 percent; (5) fractures, 9.4 percent; (6) burns and scalds, 1.79 percent; (7) dislocations, 0.78 percent; (8) loss or amputations, 0.78 percent; (9) stiffness, loss of function, 0.72 percent; (10) others, 0.72 percent.

It is observed that certain injuries of low frequency (8 to 10) have marked severity and high accident costs.

COST OF ACCIDENTS

The cost of accidents can be divided into indirect and direct costs. The indirect cost is variously estimated from 2 to 5 times the direct cost and is not enumerated in this report. The direct cost may be divided into loss of time, loss of wages, and industrial insurance cost, although usually it includes only compensation and medical and hospitalization expenses. The industrial insurance cost is variable; it covers the pure-premium cost and insurance overhead. The pure-premium cost includes compensation benefits and medical costs, items directly affected by the accident experience at each risk. This report deals primarily with the pure-premium cost of accidents; it does not discuss the factors[14] governing the establishment of compensation insurance rates.

Tables 10 to 13 have been compiled from data furnished by the California Inspection Rating Bureau and State Compensation Insurance Fund and cover mining risks insured by the insurance carriers in California for Class 1164, Mining, N.O.C.

A comprehensive study of accident costs in California reveals that the costs, as reflected by the insurance carriers' risks, can be applied with consistent results to all mining operations included in the Bureau of Mines classification and the accident experience for all mines discussed in this report, indicating that attention to safety is about the same in the majority of mines throughout the mining industry of the State.

The total benefit cost of injuries cannot be estimated from an analysis of certain high-severity injuries because permanent-disability awards are not

14 Fuller, G. V., Factors Governing the Establishment of Compensation Insurance Rates: Pit and Quarry, Dec. 30, 1931, pp. 58-62.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

necessarily in direct ratio to time lost; a crippled man does not necessarily need medical relief indefinitely. Furthermore, although fatalities constitute the maximum lost-time figure affecting accident severity, nevertheless they rank with the lowest-cost injuries in California and at times do not rank in unit cost with even the average disability-cost figure; they vitally affect compensation costs but usually do not materially influence medical costs.

A study of 1,638 accidents, including 42 fatalities, at 355 representative California metal mines shows that 51.6 percent of the temporary-disability injuries are noncompensable -- or have a time loss of less than 8 days -- and that the average compensable temporary-disability injury has a time loss of 61 days. The periods of disability per claim for other injuries in this study were: Minor permanent partial disability, 240 days; major permanent partial disability, 1,135 days; average for all permanent partial disabilities, 474 days; permanent total disability, 2,749 days; and deaths, none. The average time lost for all injuries is 101 days, which compares favorably with the average days lost (109) per accident[15] for 1928.

The cost of accidents given in this report is based upon cost experience by policy years, which means that the experience for a policy year represents the experience developed 1 year from the date of the policy and can include not only the experience of the calendar year in which the policy was written but also experience developed during the life of the policy in the following calendar year. For this reason the experience shown in this report as 1932 policy year includes all experience developed during the calendar year 1933 of policies written during 1932.

Table 9 shows the benefit-cost experience of injuries in the metal-mining industry in California for the various classes of claims by policy years.

During the 5-year periods 1924-28 and 1928-32 the cost of compensation and medical aid increased, principally because permanent total disability and fatality claims increased both in unit cost and total costs. Although the total pay roll for 1928-32 was $6,255,417 less than for 1924-28, these classes of injuries increased both in total and in unit cost.

It is encouraging to note that a decided improvement is shown for 1932, but for the calendar year 1934 fatal-accident experience is worse than the average for the past decade.

The average benefit cost per accident for all insurance carriers' risks for the 5 years 1924-28 was $453; for the 5 years 1928-32, $560; and for 1932, $477.

---

15 Adams, W. W., Metal-Mine Accidents in the United States During the Calendar Year 1928: Bull. 320, Bureau of Mines, 125 pp.

Generated on 2024-09-18 02:03 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 01:58 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 9.- Accident-cost experience for Class 1164, Mining, covering California mines insured by insurance carriers for policy years 1928-32, inclusive, and summary for 1924-28 and 1928-32

Class of injury	1924-28	1928	1929	1930	1931	1932	1928-32
Temporary disability:							
Number	2,855	440	574	449	386	265	2,114
Compensation cost (total)	$249,375	$43,674	$65,976	$44,836	$46,403	$23,752	$224,641
Compensation cost (per claim)	$87	$99	$115	$100	$120	$90	$106
Permanent partial disability:							
Number of minor claims	149	30	38	14	30	13	125
Compensation cost (minor)	$137,504	$25,859	$34,233	$13,358	$21,536	$13,497	$108,483
Compensation cost (per claim)	$923	$862	$902	$954	$718	$1,038	$868
Number of major claims	84	12	12	8	16	10	58
Compensation cost (major)	$271,262	$54,419	$34,265	$26,360	$45,188	$21,944	$182,176
Compensation cost (per claim)	$3,665	$4,535	$2,855	$3,295	$2,824	$2,194	$3,141
Number of P P D claims	223	42	50	22	46	23	183
Compensation cost (P P D)	$408,766	$30,278	$68,498	$39,718	$66,724	$35,441	$290,659
Compensation cost (per claim)	$1,832	$1,911	$1,370	$1,805	$1,450	$1,540	$1,588
Permanent total disability:							
Number	9	4	1	4	1	1	11
Compensation cost (total)	$159,440	$75,748	$19,462	$68,497	$14,000	$22,249	$199,956
Compensation cost (per claim)	$17,715	$18,937	$19,462	$17,124	$14,000	$22,249	$ 18,178
Deaths:							
Number	96	13	30	21	14	7	85
Compensation cost (total)	$130,666	$23,843	$71,993	$52,366	$39,514	$9,095	$196,811
Compensation cost (per claim)	$1,883	$1,834	$2,400	$2,493	$2,822	$1,299	$2,315
Grand total:							
Number	3,182	499	655	496	447	296	2,393
Compensation cost (total)	$998,247	$223,543	$225,929	$205,417	$166,641	$90,537	$912,067
Medical cost (total)	$442,398	$91,732	$101,773	$91,023	$94,174	$50,472	$429,224
Benefit cost (total)	$1,440,645	$315,325	$327,702	$296,440	$260,815	$141,009	$1,341,291
Compensation cost (per claim)	$314	$448	$345	$414	$373	$306	$381
Medical cost (per claim)	$139	$184	$155	$184	$210	$171	$179
Average benefit cost(per claim)	$453	$632	$500	$598	$583	$477	$560

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Table 10 shows the annual pay roll for the mines, Class 1164, N.O.C., insured by the California insurance carriers, with the various items relating to accident costs per $100 of pay roll.

California compensation insurance rates are calculated to yield a ratio of pure-premium or benefit costs to earned premium of 59.4 percent. The loss ratio for the two 5-year periods 1924-28 and 1928-32 are coincidentally 69.4 percent, but 2 years (1927 with 51.7 percent and 1932 with 52.7 percent) have dropped below the authorized ratio.

The earned-premium cost per accident reached a high of $904 in 1932, and the average for the period 1928-32 was $808 compared with $653 for the 1924-28 period.

The benefit cost for 1932 of $4.14 per $100 of pay roll is the lowest in the last decade except for 1927, when it was $4.12. The compensation cost for the policy year 1932 of $2.66 per $100 of pay roll reflects the accident experience cost for the calendar year 1933 and is the lowest for this item in over a decade.

Table 11 gives number and percentages of cases in each class of injury with the cost for each class for the two 5-policy-year periods 1924-28 and 1928-32, including actual cost experience developed at the California insurance carriers' risks for the calendar years 1924-33, inclusive.

A detailed analysis of California's accident experience shows a decidedly level trend over the past decade. Data for individual years are not a satisfactory criterion under such circumstances; 5-year periods indicate more accurately the status of factors bearing on the occurrence and cost of accidents.

Compensation Costs

Although temporary-disability claims constituted 88.74 percent of all claims for the period 1928-32, they accounted for only 16.75 percent of the pure-premium cost -- a slight decrease in the number (89.69) and cost (17.31) for the period 1924-28. Although these figures show a decrease in the number of injuries in this class, the unit compensation cost of temporary disabilities was $106 for the 5-year period 1928-32 and $90 in 1932, compared with $87 for the 5-year period 1924-28. Unfortunately, this type of claim causes the most irritation in accident-cost discussion. In this class malingering assumes large proportions, whereas in reality the cost of these claims is comparatively low when compared with that of permanent disability and (to some extent) fatalities. Although during the policy year 1932 there was only 1 permanent-total-disability claim, the cost in compensation was only $1,503 less than that for the entire 265 temporary-disability claims (table 9), and the 23 permanent-partial-disability claims cost $11,689 more in compensation than the entire 265 temporary-disability claims, or 49.2 percent of the total compensation cost of these claims. Also, during the 5-year period 1928-32, 85 permanent-disability claims cost $40,516 more than 96 similar claims for the 5-year period 1924-28. There is no doubt as to the seriousness of permanent-disability injuries

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 01:57 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 10.- Industrial insurance costs per $100 of pay roll per accident; earned premium-loss ratio; pay roll covering California mines, Class 1164, insured by insurance carriers for the policy years 1928-32, inclusive, and summary for years 1924-28 and 1928-32

Item	Year (Policy)						
	1924-28	1928	1929	1930	1931	1932	1928-32
Pay roll	$28,309,565	$4,591,711	$5,566,962	$4,630,245	$3,868,528	$3,396,702	$22,054,148
Earned premium	$2,078,047	$392,862	$515,131	$373,382	$382,594	$267,791	$1,931,760
Rate per $100 of pay roll (manual)	----------	$8.53	$9.05	$9.42	$10.54	$10.99	----------
Costs per $100 of pay roll:							
Compensation	$3.52	$4.87	$4.06	$4.43	$4.30	$2.66	$4.14
Medical	$1.56	$2.00	$1.83	$1.97	$2.43	$1.48	$1.95
Total benefit costs	$5.08	$6.87	$5.89	$6.40	$6.73	$4.14	$6.09
Earned premium	$7.44	$8.56	$9.25	$8.06	$9.87	$7.87	$8.76
Loss ratio (percent)	69.4	80.3	63.6	79.3	68.3	52.7	69.40
Industrial insurance[1] cost per claim	$653	$787	$786	$753	$857	$904	$808

1 Represents benefits and insurance administration costs.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 11.- Review of injuries showing percentage of total number and percentage of total compensation and medical costs by class of injury, Class 1164, Mining, 1924-28 and 1928-32 1

Class of injury	Percentage of total number of injuries		Percentage of total cost of injuries	
	1924-28	1928-32	1924-28	1928-32
Temporary disability:				
Noncompensable:				
Medical cases	-------	45.58	-------	2.42
Compensable:				
Compensation	-------	-------	17.31	16.75
Medical	-------	-------	-------	16.07
Subtotal	-------	42.76	-------	32.82
Total	89.69	88.34	-------	35.24
Permanent partial disability:				
Minor:				
Compensation	-------	-------	9.54	8.08
Medical	-------	-------	-------	3.36
Subtotal	4.68	5.22	-------	11.44
Major:				
Compensation	-------	-------	18.81	13.58
Medical	-------	-------	-------	5.66
Subtotal	2.35	2.43	-------	19.24
Total:				
Compensation	-------	-------	28.35	21.66
Medical	-------	-------	-------	9.02
Subtotal	7.03	7.65	-------	30.68
Permanent total disability:				
Compensation	-------	-------	11.07	14.91
Medical	-------	-------	-------	4.08
Subtotal	.28	.46	-------	18.99
Deaths:				
Compensation	-------	-------	12.57	14.67
Medical	-------	-------	-------	.42
Subtotal	3.00	3.55	-------	15.09
All injuries:				
Compensation	-------	-------	69.30	67.99
Medical	-------	-------	30.70	32.01
Grand total	100.00	100.00	100.00	100.00

1 Policy years.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

which result in loss of limbs or eyes or broken backs; to eliminate them the prevention of accidents from falls, explosives, haulage, and falling down shafts should receive more attention, and first aid should be applied at more small mines to prevent infection and other complications from both major and minor injuries.

Permanent-partial-disability claims constituted 7.65 percent of the claims for 1928-32 compared with 7.03 percent for 1924-28. On the other hand, the compensation cost of these claims compared with the total decreased from 28.35 to 21.66 percent. The unit cost per accident of this type shows a steady decrease, due in part at least to first-aid education which the industry at the larger mines has undertaken energetically since 1930.

Medical Costs

Medical costs (table 11) for the 5 years 1928-32 were 32.01 percent of the total pure-premium cost and in 1932, 35.8 percent, compared with 30.7 percent for the 5 years 1924-28. Medical care for temporary-disability injuries accounted for 18.49 percent of the total pure-premium cost and approximately 58 percent of the total medical cost. Medical cost for permanent partial disabilities accounted for 9.08 percent; permanent total disabilities, 4.08 percent; and fatal injuries, 0.42 percent of the pure-premium costs.

Medical costs are controlled largely by the procedure followed in temporary-disability injuries. The small mine plays a more important part than is realized. Otherwise than by reducing accidents, these costs can be controlled effectively only by getting the injured men back to work through the efforts of the insurance department, the doctor, and the employers. These three agencies should be advised of the status of any workmen receiving medical care.

COST OF ACCIDENTS BY CAUSES

Table 12 reviews accident costs by causes, and table 13 ranks injuries by causes in the order of importance indicated by cost, percentage of total number of injuries, and severity (time lost) of injuries.

Prevention of accidents by causes has been discussed in this report. The necessity for safer mining practice at the face is emphasized by the fact that falling objects account for 34.21 percent of the total cost of accidents and rank first in cost, number of injuries, and severity (direct measure of human suffering).

The misuse of explosives accounts for 21.46 percent of accident costs in California, ranking second in cost and severity and ninth or last in frequency; this latter fact is very misleading regarding explosives accidents in California. No single item in California mining could contribute more to accident prevention than a drastic change towards safer explosives practice. The average nonfatal injury resulting from the misuse of explosives cost $6,400. The maximum unit cost of $5,115 per injury is accounted for by explosives; injury from explosives costs 14½ times as much as the average injury and approximately 6 times the unit cost ($872) for haulage injuries, which rank second in unit cost.

Generated on 2024-09-18 01:55 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 02:02 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 12.- Review of accident-cost experience, latest available period,[1] by cause of injury

Cause and class of injury [2]	Percentage of injuries	Relative severity [3]	Percentage of total cost of all injuries	Pure-premium cost per injury		
				Compensation	Medical aid	Total
Falling objects:						
In mines:						
Deaths	1.31	38.52	5.17	$1,333	$67	$1,400
All injuries	9.29	45.14	28.77	834	265	1,099
Collapse:						
All injuries	14.46	1.24	3.10	42	34	76
All others:						
Deaths	.06	1.75	.22	1,230	60	1,290
All injuries	3.63	2.33	2.34	134	94	228
Subtotal:						
Deaths	1.37	40.27	5.39	1,328	67	1,395
All injuries	27.38	48.71	34.21	323	120	443
Explosives:						
Deaths	.42	12.23	2.13	1,793	18	1,811
All injuries	1.49	16.53	21.46	4,200	915	5,115
Haulage:						
Mine cars and trucks on rails:						
Deaths	.06	1.75	.81	4,818	7	4,825
All injuries	1.73	2.45	3.13	435	221	656
Mine cages, skips, and buckets:						
Deaths	.12	3.50	.25	690	72	762
All injuries	.53	4.49	2.96	1,226	733	1,959
Automobiles:						
Deaths	.06	1.75	.03	150	15	165
All injuries	1.19	2.68	2.33	565	128	693
Subtotal:						
Deaths	.24	7.00	1.09	1,587	41	1,628
All injuries	3.45	9.62	8.48	603	269	872

(See page 30 for footnotes).

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

TABLE 12.- Review of accident-cost experience, latest available period,[1] by cause of injury - Continued

Cause and class of injury[2]	Percentage of injuries	Relative severity[3]	Percentage of total cost of all injuries	Pure-premium cost per injury		
				Compensation	Medical aid	Total
Handling materials:						
All injuries	23.39	2.66	7.21	63	46	109
Hand tools:						
All injuries	7.75	2.72	7.06	255	69	324
Falls of persons:						
From elevations and into excavations:						
Deaths	.12	3.50	.72	2,150	9	2,159
All injuries	4.35	4.69	4.52	245	123	368
On level:						
All injuries	5.54	.43	1.33	42	43	85
Subtotal:						
Deaths	.12	3.50	.72	2,150	9	2,159
All injuries	9.89	5.12	5.84	131	78	209
Stepping or striking against objects:						
All injuries	9.22	.97	2.66	57	45	102
Flying particles:						
All injuries	6.60	.50	1.28	36	33	69
Others (not segregated):						
Deaths	.35	10.50	4.74	4,681	32	4,713
All injuries	10.83	13.17	11.80	333	54	387
Grand total:						
Deaths	2.50	73.50	14.07	1,957	50	1,997
All injuries	100.00	100.00	100.00	263	92	355

1 Data compiled from experience of State Compensation Insurance Fund - 355 mines.
2 The item "all injuries" under each heading includes deaths, if any.
3 Deaths charged 6,000 days each, nonfatal injuries actual lost time awarded.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

TABLE 13.- Causes of injuries ranked in importance according to cost, percentage, number, and severity

Cause	Rank according to -		
	Percentage of total cost of all injuries	Percentage of total number of injuries	Severity of all injuries (time lost)
Falling objects	1	1	1
Explosives	2	9	2
Cause not segregated	3	3	3
Haulage	4	8	4
Handling materials	5	2	7
Hand tools	6	6	6
Falls of persons	7	4	5
Stepping or striking against objects	8	5	8
Flying particles	9	7	9

CONCLUSIONS

A frequent complaint in various States is that compensation costs are high and are increasing. Compensation-insurance-cost rates have risen consistently, owing not so much to increased administration costs as to various other factors. The sooner it is recognized that accidents are preventable, (and in many instances actually have been prevented) the sooner they will be prevented and accident costs decline, regardless of other factors that tend to push the rates upward. In other words, the remedy for the high cost of accidents in practically all of its phases is the prevention of their occurrence, and this remedy is available to the mining industry.

A study of accident costs[16] in other Pacific Coast States shows no noticeably wide divergence in the costs and classification of injuries in States where economic conditions are essentially similar; temporary-disability injuries in mining account for 88 percent of the total number in Arizona and 88.1 percent in Washington, compared with 88.34 percent in California.

The increasing number of prospects and small "partnership" operations has injected in the California mining industry factors of growing importance as contributors to accidents, as lack of supervision, unsafe practices, unsafe equipment, and other hazards. Indirectly if not directly these will contribute much toward high accident rates with increased costs to the industry unless more attention to accident-prevention work is required in and around these small

16 Ash, S. H., Accident Experience and Cost of Accidents at Washington Metal Mines and Quarries: Tech. Paper 514, Bureau of Mines, 1932, 35 pp.

Generated on 2024-09-18 01:56 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

mines. Under the compensation laws of California partners who employ no workmen are classed as owners and do not come under the safety provisions or compensation insurance provisions of the compensation act; unquestionably this classification has a definite tendency to encourage laxity in safety in the operation of these properties.

According to statistics in this report, on the average 22 persons are killed annually at California mines, and for every person killed 60 others are injured. As a result of these nonfatal injuries approximately 60,000 days of wages are lost to the workmen aside from reduced earning capacity due to physical impairment. The wages, which alone amount to at least $270,000 annually, are returned only in part through compensation insurance. The industry is now paying annually about $1,074,000 for industrial awards -- a tax each year of at least 10 percent of California's annual gold production which gives no return except human wreckage and dependency in the community and wasted dividends. It can be reduced very materially by an increased effort to prevent accidents, possibly only by concerted continued effort, chiefly of an educational nature, but with the application of pressure by the State on those who refuse or fail to cooperate.

Generated on 2024-09-18 02:00 GMT / https://hdl.handle.net/2027/osu.32435030644066
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY